AD NUMBER
AD471194
LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; SEP 1965. Other requests shall be referred to Electronic Systems Division, Hanscom AFB, MA.

AUTHORITY

ESD ltr dtd 29 Jul 1969

ESD-TR-65-368

TM-03651/0000/00/2/00

USER'S MANUAL FOR THE COMPUTERIZED

ELECTRONIC SYSTEM COST MODEL: FY65 UPDATING

TECHNICAL REPORT NO. ESD-TR-65-368

SEPTEMBER 1965

T. J. Jannsen
J. C. DesRoches

Prepared for

DEPUTY FOR ADVANCED PLANNING

ELECTRONIC SYSTEMS DIVISION

AIR FORCE SYSTEMS COMMAND

UNITED STATES AIR FORCE

L. G. Hanscom Field, Bedford, Massachusetts

Project 600C

Prepared by

THE MITRE CORPORATION
Bedford, Massachusetts
Contract AF 19(628)-2390

ESAB

AD471194

SECURITY

MARKING

The classified or limited status of this report applies
to each page, unless otherwise marked.
Separate page printouts MUST be marked accordingly.

USER'S MANUAL FOR THE COMPUTERIZED

ELECTRONIC SYSTEM COST MODEL: FY65 UPDATING

TECHNICAL REPORT NO. ESD-TR-65-368

SEPTEMBER 1965

T. J. Jannsen
J. C. DesRoches

Prepared for

DEPUTY FOR ADVANCED PLANNING

ELECTRONIC SYSTEMS DIVISION

AIR FORCE SYSTEMS COMMAND

UNITED STATES AIR FORCE

L. G. Hanscom Field, Bedford, Massachusetts

Project 600C

Prepared by

THE MITRE CORPORATION
Bedford, Massachusetts
Contract AF 19(628)-2390

FOREWORD

This report represents the third in a series on the computerized electronic system cost model. The basic document is available as ESD-TDR-63-443, and its first supplement is identified as ESD-TDR-64-126.

ABSTRACT

The computerized electronic system cost model was originally developed for an IBM 7090 FORTRAN II program. Subsequently, it was converted to an IBM 7030 FORTRAN IV program. Recent modifications, described in this report, reflect new operational requirements and incorporate some new FORTRAN IV programming features.

REVIEW AND APPROVAL

This technical report has been reviewed and is approved.
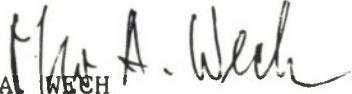
OTTO A. WECH
Technical Advisor
Director of Analysis
Deputy for Advanced Planning

TABLE OF CONTENTS

SECTION I

INTRODUCTION

The computerized electronic system cost model has been further modified to reflect changing operational requirements related to the cost analysis of alternative air defense systems,[1] [1] and to incorporate some new FORTAN IV programming features.

The output report for the cost structure (Table S) has been changed to permit inclusion of an eleventh subsystem. Also, specialized cost elements for a particular system, formerly put in the tenth subsystem, may now be inserted in their proper logical places in the existing cost structure.

By making use of the BLOCK DATA and variable dimension concepts, it is now possible to dynamically allocate the storage required for the various CER parameters, thus obviating the necessity of predicting CER usage in advance. In addition, various program constants have been defined by BLOCK DATA, minimizing the number of literals in the program and simplifying the modification procedure, should further changes become necessary. Finally, additional subroutines have been added to the CER package to simplify the costing procedure.

These changes are discussed in more detail below in the order in which the now modified sections appeared in the original text.[2]

----

[1] Numbers in brackets denote references listed at end of report.

SECTION II

CERs

The Factor CERs (Section 3.2.4 of Ref.[2]) have been modified and seven new CERs added.

FACTOR CERs 16, 17, 18

The Factor CERs have been modified to allow for more flexibility in costing multisite configurations. Estimates of the equipments for a unit site are entered on 06 cards, converted to dollars, and summed within the computer to obtain the cost of a basic configuration. These costs are then multiplied by the number of sites to obtain a total cost. The number of sites is specified as an additional parameter on the 02 card, and references an integer defined by an 03 factor.

SITE CONFIGURATIONS (CERs 33, 34, 35)

Site-configuration CERs have been added to the CER package to provide the capability of obtaining unit site-configuration costs. In these CERs, the number of equipments, a_i, and the costs of each, b_i, are specified as parameters on the 02 card, and reference integers and costs, respectively, are defined by 03 factors. The estimates are multiplied by the costs and summed to obtain the cost of a basic configuration. This unit cost, in millions of dollars, is printed on the system output tape. Appropriate parameters are set to specify one factor and one site, and control is transferred to subroutine FACTOR, where the cost of a basic configuration is applied to the time-phased estimates of configuration requirements as specified on the 06 data card.

CERs 33, 34, and 35 operate on three, five, and seven equipments per configuration. By the use of dummy zero-constants for a_i and b_i, configurations of two, four, or six equipments may be tailored to meet the three-five-seven restriction. The order on the 02 card is a_i, b_i; $i = 1 \ldots N$ where $N = 3, 5,$ or 7.

TOTAL CERs

The maximum number of parameters associated with a CER has been increased from 10 to 14. This makes it possible to immediately extend the CER TOTAL to sum over an increased number of cost elements. CERs 36, 37, 38, and 39 have been defined to total 11, 12, 13, and 14 cost elements, respectively.

UNASSIGNED CERs

Provision has been made for a total of 45 CERs. With the extensions outlined above, six CER subroutines remain undefined and are referred to as SUBA1....SUBA6.

SECTION III

REVISED INPUT

To reflect the modifications described in the present report, several changes have been made to input card formats and the table tape.

REVISED CARD INPUT

The system run and pass control cards (Section 4.1.2 of Ref. 2) have been altered.

System Card (01)

The revised system card layout is as follows:

Card Column	Information
1-2	Card code (01)
3-10	System name or number (alphanumeric)
11-13	Number of runs for the system
15-16	Number of passes per run
18-19	Last two digits of year corresponding to year N on input cost element estimate sheet
20-52	Number of elements in each of the eleven subsystems of the structure, three columns per subsystem
54	Number of decimal places, in millions of dollars, for Table R (Table A overruns)
55-57	Table number assigned to Table R (alphanumeric characters)

4

Card Column (cont'd)	Information (cont'd)
58	1 = yes, 0 = no; for printing elements in Table I that are not costed
59	1 = yes, 0 = no; for printing Table
60-61	Number of lines to be printed on a Table I page, before starting a new page, when different from 53
62-63	Number of lines to be printed on a Table I page, before starting a new page with another subsystem, when different from 45

Note that the system name field has been expanded from six to eight characters and that provision is now made for eleven subsystems.

Run Card

The revised run card layout is as follows:

Card Column	Information
1-2	Card code (04)
3-9	Blank
11-13	Run number
14-16	Blank
18	1 = yes, 0 = no -- for printing Table A
20	Number of decimal places in Table A (if 1 in column 18)
21-23	Table number of Table A (alphanumeric characters), if 1 in column 18

5

Card Column (cont'd)	Information (cont'd)
25-51	Similar to columns 18 , 20 , and 21 to 23 for Tables B , C , D , and E
52	1 = yes, 0 = no; for suppression of zero cost elements in Table S
53	1 = yes, 0 = no; for printing Table S
55-58	Similar to columns 20 and 21 to 23 for Table S
60-65	Similar to columns 18 , 20 , and 21 to 23 for Table P
67-68	Number of factors first incremented in this run
69-70	Number of factors changed for this run only (not including factors controlled by increments)
71-72	Number of input cost element estimate cards changed for this run only
73-80	Identification

Note that the system name is no longer required and that zero suppression has been added for Table S.

Pass Card

This card is as defined,[2] with the exception that the field for the system name (i. e. , columns 3 to 9) is no longer read and may be omitted.

TABLE TAPE

The mechanics of adding new elements to the structure will be discussed in Section IV. Briefly, new elements are assigned sequential numbers, using the last number of the structure as the base. The format of Table S is determined by the order of the elements on the table tape. Therefore, it becomes necessary to record on this tape, not only the nomenclature associated with each element in the structure but also the element number. The nomenclature is punched in columns 1 through 30 , and the element number in columns 40 through 43.

Because of the manner in which 7030 IOCS treats zeros and blanks, it is necessary to generate this tape in the EVEN parity mode.

SECTION IV

STRUCTURE MODIFICATION

The method of making minor modifications, i. e. , adding new cost elements, to the cost structure has been changed somewhat from that described in Ref. [2].[2] One still accomplishes the modifications by setting to zero undesired elements in the basic structure and by defining new elements to be added. New elements are assigned numbers, starting with the last number in the basic structure (i. e., 1260) as the base. The numbering of the elements in the structure need not be sequential since the order of Table S is solely determined by the order of the elements as recorded on the table tape. [3] However, these additional elements are no longer "assigned" to the tenth subsystem; rather, they are assumed to be in their logical subsystem. For example, two items of Data-Processing Mission Hardware are added and assigned sequence numbers 1261 and 1262. Formerly, these would show as two elements in the tenth subsystem, columns 52 through 54 of the 01 system card. Now however, they are treated as being in subsystem two and the element count for this subsystem must be changed from 33 to 35, columns 23 through 25 of the 01 system card. If, in fact, one or two new subsystems is to be added, the element counts would be shown in the proper place on the 01 card; viz., columns 47 through 49 or 50 through 52, respectively.

The reason for these changes in accounting for additional elements is that control over element ordering is now accomplished by the nomenclature

---

[2] Cf. Sections 4. 1. 2 and 4. 5.

[3] Cf. Section 3. 2. 1.

8

section of the table tape. Thus, in the first example cited, the two new elements 1261 and 1262 would be inserted in the nomenclature card deck (and subsequently tape) immediately following Element 1027, Mission Hardware.

As before, an 02 parameter card must be provided, in addition to the 06 cards required, for each additional element. If the run is to generate a Table I output report, type 15 Unit-of-Measure Cards must also be included.[3]

A major structural change, i.e., an entirely new structure, can, as before, be made. The total number of lines in the structure may not exceed 500. However, these 500 lines may be allocated over eleven subsystems in any manner dictated by the nature of the system being costed. The number of elements in each subsystem, N_i, is defined on the 01 system card, where $1 \ldots M$, $M_{Max} = 11$ and $N_i \neq 0$.

SECTION V

BLOCK DATA

Provision has been made to allocate 3500 locations for the storage of CER parameters in an array called NPX. This block of storage may be divided among a maximum of 45 CERs in any arbitrary manner. The number of parameters which may be associated with a CER has been raised from 10 to 14. The number of parameters for each CER and CER utilization for the current run is defined in a data statement by IPAR (I, J). The elements for this matrix are defined in Section VI.

There are five standard output tables in fixed block format in the MOD II version of the cost model. For example, Table A consists of four blocks, with 4, 6, 6, 1 lines of data, respectively. In this version, it is possible, within the constraints of the total number of lines in a table, to reblock a table into a maximum of six blocks with any number of lines of data to a block. The table configuration is defined in a data statement by NT (I, J), where, for each table, $J = 1, 5$; $I = 1 =$ number of blocks; $I = 2, 7 =$ number of lines for each block.

To avoid the repetition of format statements through the program, the format for type 06 data input cards, and for a line of processed cost data, has been defined in BLOCK DATA by the arrays FMTI and FMTO, respectively. The following variables are also defined:

Mnemonic	Meaning	Current Value
NFP	Maximum number of factors and percents	500
NR	Maximum number of 06 cards	600
NRR	Maximum number of -6 cards/run	100

10

(continued)

Mnemonic	Meaning	Current Value
NIN	Maximum number of incremental changes	60
MNP	Maximum number of parameters	14
NFC	Number of fields on 06 card	15
NBC	Code to signify the presence or absence of budget code on 06 cards; 0 = yes, 1 = no	0
NFS	Number of fields in structure	14
NFT	Number of fields in tables	13
NLE	Number of last element	260

SECTION VI

DYNAMIC ALLOCATION OF CER PARAMETERS

IPAR (I, J) is a matrix, which specified for each CER, J = 1, 45;

$\quad$ I = 1 = number of parameters + 1

$\quad$ I = 2 = number of times CER J is to be used

$\quad$ I = 3 = starting location in NPX for storage of
$\qquad$ CER J parameters

The first two parameters are input in BLOCK DATA and the third is computed in subroutine PARAM. For each CER parameter definition, subroutine PARAM performs the following sequential steps. The type 02 parameter card is read, the CER and index[4] thereof identified, and the parameters stored in temporary locations. Subroutine SPARAM is then called with the following arguments in the transfer vector:

$\quad$ (a) $\quad$ Starting location in NPX for the CER;

$\quad$ (b) $\quad$ CER dimensions as defined in IPAR, and

$\quad$ (c) $\quad$ CER index.

With this information, subroutine SPARAM then moves the CER parameters from temporary storage into the proper location in NPX [5].

---

[4] Last two digits of four-digit CER number, input on 02 card in columns 5 and 6.

[5] See Section VIII for restrictions on CER usage.

SECTION VII

GENERATION OF VARIABLE OUTPUT REPORTS

As described in Section V, "Block Data," the format of the five basic output tables, i. e., Tables A through E , can be defined within the constraints of the total number of lines in each table, i. e., Table A , 17 lines; Table B , 52 lines; Table C , 32 lines; Table D , 40 lines; Table E , 48 lines. However, this line count restriction can be eliminated by using the techniques described in Section VI to dynamically allocate storage at execution time. This additional modification to the program will be implemented as soon as there is a demand for its application.

SECTION VIII

PROGRAM SPECIFICATIONS

The cost model in its current form requires $37,347_{10}$ locations of core storage for data, 7650_{10} locations of core storage for instructions, and 3378_{10} locations of core storage for library subroutines, totaling to $48,375_{10}$ locations.

The MOD III version is designed to operate on a structure of 500 elements (maximum of 600 data input cards), 500 factors and percents, 100 lines of revised element estimates per run, 100 modified factors and percents and 60 incremental changes. The number of parameters associated with a CER has been increased to 14, the number of CERs to 45. There is no limit to the number of times a CER may be referenced within the constraint that product of the number of parameters + 1 and number of times a CER is used, summed over all CERs, may not exceed 3500. Therefore, Table 4 of Ref. [3] is no longer an operative constraint, and should be ignored.

The program is written entirely in FORTAN IV, with the exception of a STRAP subroutine SHDUMP. The function of this subroutine is to set up the table of exits, so that abnormal end-of-jobs will be terminated by a floating point core dump instead of the octal core dump which the Monitor normally provides.

REFERENCES

1. T. J. Jannsen, "Air Defense Cost Model (U)" The MITRE Corporation, W-7369, Contract AF 19(628)-2390, 2 November 1964 (SECRET).

2. T. J. Jannsen, H. Glazer and J. C. DesRoches, "User's Manual for the Computerized Electronic System Cost Model," ESD-TDR-63-446, October 1964 (UNCLASSIFIED); obtainable from CFSTI under AD No. 608-057.

3. B. L. Moores, "User's Manual for the Computerized Electronic System Cost Model: 7030 Modifications," ESD-TDR-64-126, October 1964 (UNCLASSIFIED); obtainable from CFSTI under AD No. 608-065.

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*	2a. REPORT SECURITY CLASSIFICATION
The MITRE Corporation Bedford, Massachusetts	Unclassified
	2b. GROUP

3. REPORT TITLE

User's Manual for the Computerized Electronic System Cost Model: FY65 Updating

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

N/A

5. AUTHOR(S) *(Last name, first name, initial)*

Jannson, Thomas J. and DesRoches, Joan C.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
September 1965	19	3

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
AF 19(628)-2390	ESD-TR-65-368
b. PROJECT NO. 600C	
c.	9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*
d.	TM-03651/0000/00/2/00

10. AVAILABILITY/LIMITATION NOTICES

Qualified requesters may obtain from DDC.
DDC release to CFSTI (formerly OTS) not authorized.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Deputy for Advanced Planning, Electronic Systems Division L. G. Hanscom Field, Bedford, Massachusetts

13. ABSTRACT

The computerized electronic system cost model was originally developed for an IBM 7090 FORTRAN II program. Subsequently, it was converted to an IBM 7030 FORTRAN IV program. Recent modifications, described in this report, reflect new operational requirements and incorporate some new FORTRAN IV programming features.

DD FORM 1 JAN 64 **1473**

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT

COST MODEL
  Computerized, modifications
COMPUTER PROGRAMS
  FORTRAN II, computerized electronic system
  cost model, modifications						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization (corporate author) issuing the report.

2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES: Enter the total number of references cited in the report.

8a. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers (either by the originator or by the sponsor), also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through
_____ ."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through
_____ ."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through
_____ ."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring (paying for) the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as (TS), (S), (C), or (U).

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, rules, and weights is optional